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Enlistment Effects of the 2+2+4 Recruiting Experiment

Richard Buddin

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PREFACE

This report describes the enlistment effects of a national experiment on a new U.S. Army recruiting program, called the "2+2+4" recruiting option. The 2+2+4 program is a tool that can help the Army attract high-quality young people during difficult recruiting periods and help channel trained, experienced personnel into the reserve force. The program expands eligibility for the Army's postservice educational benefit to include recruits entering two-year active-duty tours in selected noncombat occupational specialties, provided that they agree to serve an additional two years in the Selected Reserve.

The Army and the Office of the Secretary of Defense developed the new program on an experimental basis, and the Congress provided authority to initiate the program as a test, with the stipulation that it be carefully evaluated. RAND's role has been to design the evaluation mechanism, to identify possible program effects, to ensure the statistical integrity of the test, and to analyze the test results. An earlier RAND Note set forth the design for the test as a controlled experiment, similar to earlier enlistment incentive tests,[1] and presented preliminary tabulations of results during the first six months of the experiment.[2] This study examines the data from the full test period and presents multivariate analyses of program enlistment effects.

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[1]See J. Michael Polich, J. N. Dertouzos, and S. James Press, *The Enlistment Bonus Experiment*, RAND, R-3353-FMP, 1986; and Richard L. Fernandez, *Enlistment Effects and Policy Implications of the Educational Assistance Test Program*, RAND, R-2935-MRAL, 1982.

[2]See Richard Buddin and J. Michael Polich, *The 2+2+4 Recruiting Experiment: Design and Initial Results*, RAND, N-3187-A, October 1990.

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Lynn E. Davis is Vice President of the Army Research Division and Director of the Arroyo Center. Those interested in further information about the Arroyo Center should contact her office directly:

Lynn E. Davis
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138

SUMMARY

The Army relies on a number of recruiting incentive programs to enhance its ability to attract high-quality enlistees. Prominent among these incentives is the Army College Fund (ACF), a benefit that can be used by the enlistee to support postservice education.[1] To attract more high-quality people during periods of recruiting difficulty, the Army proposed to expand the ACF to cover certain types of two-year enlistments under a new option known as the "2+2+4" program. Under special authority from the Congress, the 2+2+4 program was tested in a national experiment from July 1989 through September 1990. This report analyzes the enlistment effects shown by the test.

Under the 2+2+4 program, recruits can choose a two-year active-duty tour in selected noncombat occupational specialties, with an additional commitment of two years in the Selected Reserve and approximately four years in the Individual Ready Reserve (IRR). The option is aimed at high-quality, college-bound youth and offers ACF benefits of $8000. The purposes are first to increase high-quality enlistments in the active-duty forces and second to increase the supply of trained manpower moving from the active forces into the Army's reserve components.[2]

PROGRAM FEATURES AND POTENTIAL EFFECTS

In recent years, the Office of the Secretary of Defense (OSD) and the Congress have restricted Army utilization of two-year active-duty tours because of concerns about the cost-effectiveness of the short tours. Several features of the 2+2+4 program were designed to improve its cost-effectiveness. First, the option is restricted to special-

[1]The ACF is an amount added to a service member's fund for postservice education. All service members are eligible to participate in the "GI Bill" educational program, which provides up to $9000 in the fund in return for an investment of $1200 made by the member during the first year of service. Active-duty recruits who enter designated critical skills and who have qualifying test scores and high school diplomas are also eligible for the ACF, which adds between $8000 and $14,400 to their educational fund, depending on term of service.

[2]This study examines the program's effects on active-duty enlistments. The Department of Defense (DoD) expects that the program will provide substantial numbers of trained, experienced personnel for the Selected Reserve because all program participants made a commitment to serve a reserve tour. However, it will require several additional years before the DoD can empirically observe the rates at which the test cohorts transition into the reserve components.

ties with short training times, and recruits are required to serve two years in the active Army *after* completion of basic and Advanced Individual Training (AIT). Second, the reserve commitment enhances the return on the active-duty training investment. ACF payments are contingent on reserve participation and program participants must agree to accept a reserve slot in their active duty skill if one is available in their local area after they leave the active Army. The selection of skill eligible for the program was based on both active and reserve force needs.

The cost-effectiveness of the 2+2+4 option depends on the magnitude of both enlistment and longer-term effects. The experiment was designed to provide evidence on the size of these effects. The most likely short-term enlistment effects of the program are as follows:

- *Market expansion.* The Army expected that the 2+2+4 program would expand the market of high-quality youth interested in military service. For example, the availability of the ACF for two-year noncombat specialties might attract new people who would not enlist without the 2+2+4 program. An important purpose of the experiment was to test this assumption.
- *Skill and term-of-service distributions.* The new program may affect recruits' choices of occupational specialties ("skills") and terms of obligated service. For example, the program could induce more enlistees to agree to train for jobs in hard-to-fill noncombat specialties that are eligible for the 2+2+4 option. Also—as a "downside" example—the program could induce some recruits who might have enlisted even in the absence of the program to move from a four-year to a two-year term of commitment, in which case the Army might lose active-duty man-years. The test was specially set up to assess these possibilities.

In the longer term, the entry of such recruits could lead to changes in other aspects of the total Army personnel and training system, such as requirements for active-duty training, availability of prior-service recruits to the reserves, and recruiting and training activities needed to sustain the reserves. However, these effects can be assessed empirically only after the test cohorts have passed through their periods of active and reserve service.

TEST DESIGN

The effects of the test were estimated through a two-part test design, including a job-offer experiment and a geographically based experiment.

Job-Offer Experiment

In the job-offer experiment, individual applicants for the Army were randomly assigned eligibility for the 2+2+4 program through the Army's job reservation system (REQUEST) at the time they discussed enlistment with an Army job counselor. The job-offer portion of the experiment provided precise estimates of how the 2+2+4 program affected the recruits' choices among skills and terms of service. Program offers varied randomly across individuals, so program effects can be separated from factors extraneous to the program.

Geographic Experiment

In the second part of the design, matched sets of geographic areas were assigned to varying programs. This portion of the design was intended to assess whether the 2+2+4 program led to a "market expansion"—that is, to an increase in the total number of high-quality persons entering the active Army. Such market expansion could occur, for example, because of promotion of the program by recruiters or guidance counselors, or because of the spread of information among prospective recruits. A geographic design made it possible to detect and analyze such effects.

TEST RESULTS

Program Participation

The 2+2+4 program was well received, and the Army wrote over 6800 enlistment contracts under the experimental offering. Program sales constituted about 8 percent of all high-quality sales during the test period. Program sales were strong throughout the test period and across a broad range of eligible skills for both men and women. About 21 percent of the seats in the eligible skills were filled by program participants, and 32 percent of the high-quality contracts in these jobs were in the 2+2+4 program.

Market Expansion

The 2+2+4 program expanded the market for high-quality male recruits by about 3 percent. Considering that this program is a modest enhancement to a well-established ACF program, this effect is a promising result and about the size that was anticipated. By comparison, previous experiments showed that a large enlistment bonus ($8000) expanded the market by 5 percent, and the Army's first enhanced educational benefit plan (similar to the full ACF program) ex-

panded the market by 9 percent (Fernandez, 1982; Polich et al., 1986).[3] The results imply that approximately 25 to 30 percent of the men taking the program are new recruits.

Term of Service and Skill Distribution

The job-offer portion of the experiment produced data on a large number of individual enlistees who were randomly assigned to eligibility or ineligibility. The job-offer data provide estimates of the "buy-down" effects on term of service and the "buy-over" effects from combat to noncombat skills. These results are important, especially the term-of-service effect, because a reduction in average term of service is often viewed as a risk of the program.

The analysis indicates that the 2+2+4 program did not shift a large number of recruits away from longer terms of service. The share of recruits choosing a two-year enlistment rose from about 21 percent among persons in the ineligible test cell to 24 percent in the eligible cell. The increase in two-year enlistments was driven primarily by a decline in three-year enlistments. Four-year enlistments did not decline significantly. The buy-down effect of the program is thus fairly limited; and, among three-year enlistees, where the effect is concentrated, it is partially offset by the program requirement that participants serve a two-year enlistment *plus training time*, or about two-and-a-half years of active duty.

The program did channel recruits into those hard-to-fill noncombat skills that participated in the 2+2+4 program. The share of recruits in participating skills rose three percentage points in the test eligible cell (group) as compared with the ineligible cell, representing a 16 percent increase in enlistments in the participating noncombat skills. Overall, the buy-over reflected a 3 percent reduction in individuals choosing combat skills with little change in individuals choosing other noncombat specialties.

Overall, the program seems to have accomplished its objectives for active-duty recruiting. The 2+2+4 option sold readily and benefited virtually all of the occupational specialties for which it was tested. During the test, about 8 percent of all high-quality enlistments contracts were written under the 2+2+4 program. Moreover, the analysis

[3]Separate supply estimates could not be obtained for women because women comprise a small share of overall enlistments and because women are demand constrained in the current recruiting environment. Combined male and female estimates produced expansion effects that were comparable to those reported for males separately.

indicates that the program attracted additional high-quality recruits into the Army and caused only a small number to change from a longer term of service to a shorter term. The results suggest that many people were willing to make the commitment to reserve service, thus providing an additional supply of manpower to both the active and reserve components.

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1. INTRODUCTION

This report describes the enlistment effects of the 2+2+4 recruiting experiment. The 2+2+4 program is a new Army recruiting incentive aimed at attracting high-quality personnel into the active Army and encouraging their later participation in the reserves. The program offers qualified recruits an additional option, beyond the normal set of enlistment benefits and choices: they may receive the Army College Fund (ACF)[1] if they enter an eligible specialty for a two-year term of active service, provided that they agree to serve an additional two-year term in the Selected Reserve. This program was tested in a national experiment from July 1989 through September 1990.

The 2+2+4 program was intended to serve dual purposes. First, it was expected to attract new persons into the active Army. This expectation was based on the Army's hypothesis that a significant number of young people are willing to enter Army service to obtain educational benefits such as the ACF, provided that they must serve only a short tour. Second, it was expected to provide a source of trained manpower to the reserve components, based on the hypothesis that many young people would readily make the reserve commitment. This report focuses primarily on the first of these purposes, examining the enlistment effects of the 2+2+4 program. The program may have other effects, appearing at later stages of soldiers' military careers, but these effects cannot be observed empirically until the experimental cohorts have passed through those stages.[2]

The 2+2+4 program could have three plausible types of effects on active-duty enlistments. First, the additional incentive might expand

[1]The ACF is an amount added to a service member's fund for postservice education. All service members are eligible to participate in the "GI Bill" educational program, which provides up to $9000 in the fund in return for an investment of $1200 made by the member during the first year of service. Active-duty recruits who enter designated critical skills and who have qualifying test scores and high school diplomas are also eligible for the ACF, which adds between $8000 and $14,400 to their educational fund, depending on term of service.

[2]For example, active-duty personnel management will be affected by the program because of changes in man-years per recruit, training needs, and recruiting requirements. The reserve implications depend on transition rates to the reserves after the completion of active service, the propensity of 2+2+4 participants to fill reserve seats in their active-duty skills, and whether they satisfactorily complete their reserve service. The Military Occupational Specialty (MOS)-match rate will depend on both individual willingness to serve in their active-duty skill and the availability of reserve vacancies in that skill in the individual's local area.

the market for high-quality recruits by attracting an untapped, college-bound youth market that is unwilling to commit to other Army programs. Second, the program might draw recruits into shorter enlistment terms. Third, the program would ideally channel recruits into hard-to-fill occupations chosen for the program, and it would be easier to attract individuals who otherwise would not have enlisted into more popular skills. A risk of the program was that it might not attract many new recruits and could lead to a reduction in obligated man-years, because recruits who would have enlisted for four years might forgo that option in favor of the 2+2+4 program.

The 2+2+4 program was tested during a period of extraordinary transition in recruiting. Much of the initial impetus for the program was a perceived shortfall in active-duty recruiting. By January of 1990, however, the recruiting mission was reduced sharply in response to the changing political climate in Europe and anticipated reductions in Army endstrength. During the spring of 1990, the Army concentrated almost exclusively on recruiting in the high-quality market, and the low-quality mission was reduced to nearly zero.

Force reductions may reduce the need for some recruiting incentives, but cost-effective tools will be needed to attract quality recruits and channel them into hard-to-fill skills. In the new environment, the reserve obligation associated with the 2+2+4 program may make the program particularly useful. A smaller active-duty force would place greater demands on the reserves and enhance the need for a well-trained, experienced reserve force. A reduction in the length of active-duty terms would increase the numbers of individuals recruited and trained for the active force, but shorter active terms would also increase the pool of prior-service personnel available to the reserves. Programs like the 2+2+4 might take on growing importance in this new environment because they funnel trained personnel to the reserves and provide incentives for them to remain in their trained occupational specialty.[3]

[3]Previous research has shown that many prior-service personnel are not matched with their active-duty skill in the reserves. Retraining is protracted because reservists must train on a part-time basis. If trained and experienced soldiers were matched with their active-duty skills, the training burden on reserve units would be reduced.

The Senate Armed Services Committee has directed the services to increase reliance on two- and three-year enlistments as part of a military restructuring that will shift greater reliance on the reserve components. The committee has directed the Secretary of Defense to develop programs "along the lines of the Army's two plus two plus four program." See *National Defense Authorization Act for Fiscal Year 1991*, U.S. Senate Report 101-384, July 1990.

The reserve aspects of the 2+2+4 program may assume greater importance in the aftermath of Operation Desert Shield/Storm (ODS). Many experts anticipate the reserve callup will have negative effects on reserve recruiting and retention. If shortages do occur, the reserves may benefit from an influx of 2+2+4 program participants as they begin leaving the active service in the fall and winter of 1991.

ORIGIN OF THE TEST

Army recruiting and personnel managers have long believed the combination of a large educational benefit and a two-year term for noncombat skills would significantly improve the Army's recruiting posture. In the late 1980s, however, the Congress prohibited the payment of special educational benefits to two-year recruits, except in the case of combat skills.[4] The restriction was based on a perception that short terms of enlistment are likely to yield less value to the government (e.g., fewer trained man-years) than longer terms.

The issue gained currency in early 1989, when the Army began to encounter increasing difficulties in recruiting for the active component. This situation prompted renewed concern within the Army and Office of the Secretary of Defense (OSD) that some form of ACF benefits for noncombat skills should be reinstated. To improve active recruiting, the Assistant Secretary of Defense for Force Management and Personnel requested congressional authority to begin a new two-year, noncombat ACF program on a test basis. The program was also expected to improve the manning posture of the reserves, since the contemplated program would link a two-year active enlistment to an additional term of service in a reserve unit. OSD assured the committees that the test would be carefully limited and structured to address issues of cost-effectiveness. At the request of the Army and OSD, RAND designed the test and agreed to take a lead role in evaluating its results. In mid-1989, the design was approved and the Congress enacted legislation permitting a 15-month test of the special program.

PROGRAM FEATURES

Preliminary RAND analysis of issues in the two-year option suggested a number of conditions that would contribute to the cost-effec-

[4]Action by the House Appropriations Committee in 1988 prohibited the payment of ACF benefits to two-year recruits in noncombat skills. Before that time, the Department of Defense had the option of permitting such benefits, which had been offered in earlier years.

tiveness of a two-year active-duty term. Prominent among such conditions are (1) the extent to which the two-year option might expand the recruiting market (i.e., bring in new recruits who otherwise would not enlist), (2) the cost of active-duty training for two-year enlistees, and (3) the extent to which the two-year active enlistment program may increase the input of trained personnel into the Selected Reserve. These conditions suggest that a maximally cost-effective program should be designed to appeal to a broad segment of youth, be restricted to skills with moderate training times and costs, and be structured to encourage people to enter the Selected Reserve after their two-year term of active service.

The Army considered these features when it subsequently designed the 2+2+4 test program. Under the new program, a recruit was offered an ACF benefit for enlisting in a noncombat skill if he committed to three conditions:

- Two years of service, plus training time, in the active Army;
- Two additional years of service in the Selected Reserve; and
- The remainder of his eight-year legal obligation in the Individual Ready Reserve (IRR).[5]

The program required commitments that were more favorable to the Army than earlier two-year enlistment programs. First, its provisions required that the enlistee serve an active-duty term slightly longer than the nominal two years; the term was two years after completion of basic training and Advanced Individual Training (AIT), some four to six months. Second, the reserve commitment would sharply increase the number of two-year personnel entering the Selected Reserve.[6] Historical data suggest that under present programs about 50 percent of a two-year active-duty cohort will enter the Selected Reserve; that rate should be much higher under the 2+2+4 program.

The Army placed a number of conditions and limits on this program to target it where needed and to improve its potential for cost-effecti[illegible]. The main conditions were as follows:

[5]The Selected Reserve includes the U.S. Army Reserve and the Army National Guard. Members of the Selected Reserve meet with their units regularly for drills (normally one weekend per month) and attend a two-week annual training period at an active training facility. All enlistees begin service with an eight-year obligation; that part of their eight-year period which is not served on active duty or in the Selected Reserve is automatically served in the IRR.

[6]The Army plans to require reserve service as a condition for making ACF payments to 2+2+4 program participants.

- *Number of training seats.* The number of 2+2+4 contracts was limited to an annual total of 5000 seats.[7]
- *High-quality personnel.* Like other educational incentives, the program was offered only to "high-quality" recruits, that is, high school graduates with Armed Forces Qualification Test (AFQT) scores at or above the 50th percentile.
- *Eligible skills.* The program was limited to specified Military Occupational Specialties, selected by the Army to meet criteria consonant with those RAND had suggested in an earlier preliminary analysis: (a) eligible skills have lower-than-average rates of "fill" of high-quality people relative to the Army's goal, (b) AIT training time must be no longer than 14 weeks, and (c) vacancies in the skill must be widely distributed in reserve units across the country.
- *Reserve skill commitment.* The recruit had to agree, in the enlistment contract, to accept a reserve slot in his active skill, if one is available within a reasonable commuting distance after he leaves the active Army. This provision should increase the reserve component's ability to profit from active-duty skill training.

Of course, the two-year noncombat program is only one of a number of job-related choices that may enter into a military applicant's enlistment decision. Table 1 displays the ACF-related options for a recruit considering a skill eligible for the ACF benefit. The choices available in the baseline, or pretest condition, are shown in the top panel of the table. Under the baseline program, the recruit can choose a combat skill and receive the regular ACF amounts: $14,400 for a four-year term, $12,000 for a three-year term, or $8000 for a two-year term. In addition, the same recruit can choose a noncombat skill for a four-year or three-year term, in which case he receives the corresponding ACF benefit; or he can select a two-year term in a noncombat skill and receive no ACF.

The second panel of the table shows an additional choice that the 2+2+4 program offers: the possibility of committing to a two-year active term in a participating noncombat skill, plus an additional two-year tour in the Selected Reserve. The recruit who makes such a

[7]Most recruits enter the Army under a delayed enlistment program (DEP) and agree to start active-duty service several months after signing their enlistment contract. Historically, DEP attrition rates have averaged 10 to 15 percent, so 5500 to 5900 contracts are required to produce 5000 annual seats (assuming that the program had no effect on DEP attrition rates). Program sales and DEP attrition are discussed in greater detail in Sec. 3.

Table 1

ACF Choices Facing Applicants (amounts in addition to "GI Bill")

Term of Service	Program-Eligible Skills	
	Combat	Noncombat
Four years	$14,400	$14,400
Three years	12,000	12,000
Two years	8,000	0
Two years (2+2+4 program)		8,000[a]

[a]To receive ACF benefit in a noncombat skill, the recruit must accept a two-year additional reserve commitment.

commitment is then entitled to receive the $8000 educational benefit. Note that this is an *additional* option that a high-quality recruit may consider; all of the other options shown in the top part of the table are still available as well.

ORGANIZATION OF THIS REPORT

Section 2 reviews the experimental design. Section 3 examines the scope of the 2+2+4 program relative to overall Army enlistments. Section 4 reports the enlistment effects of the experiment and develops a multivariate approach to assess the market expansion effects of the program. It also addresses the skill-channelling and term-of-service effects from the results of the job-offer portion of the experiment. Section 5 summarizes the results on the enlistment aspects of the 2+2+4 incentive program.

2. EXPERIMENTAL DESIGN

Because the enlistment process involves several stages, a comprehensive test design must measure effects at different points in the process, as depicted in Fig. 1.[1] The 2+2+4 program was available only to high-quality recruits in a select number of noncombat occupations, so some program effects were likely to occur relatively late in the enlistment process when recruits meet with an Army job counselor to discuss specific offers and options. Therefore, a key element of the test design was a *job-offer experiment* that randomly assigned qualified Army applicants to varying program conditions. This portion of the design made it possible to estimate how eligibility for the 2+2+4 program affected the decision of qualified applicants to join the Army and their subsequent skill and term-of-service decisions.

However, the job-offer experiment could not capture the full effects of the program if the program expanded the market of qualified applicants meeting with job counselors. A new recruiting incentive could

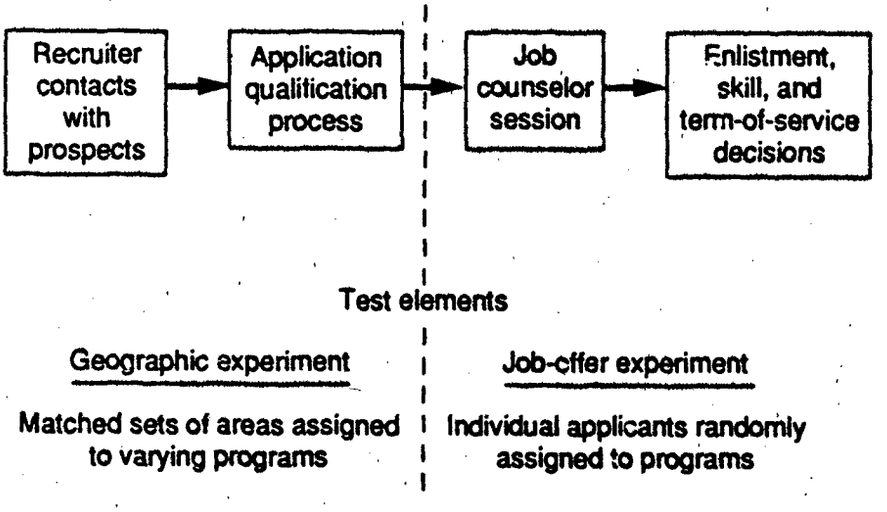

Fig. 1—Enlistment Process and Test Elements

[1]This section is based on Buddin and Polich, 1990.

potentially generate market expansion in several ways. The availability of the 2+2+4 program *could* increase recruiter contacts with prospects because the program generates either more interest in the Army or interest among a new subset of the target population. The program might also increase the number of applicants because more contacts are interested in pursuing their options. Finally, the program could increase the likelihood that some partially eligible applicants stay in the system, satisfy their eligibility requirements, and talk with the job counselor. The 2+2+4 program might be a recruiting success if it increased the number of qualified applicants meeting a job counselor, even if the enlistment rate of the qualified applicants was unaffected.

To assess whether the test program led to an overall market expansion, we employed a *geographic experiment*. Under the geographic plan, matched sets of areas were assigned to different program cells. This made it possible to compare the overall numbers of enlistments in test and control areas.

This test design is more complicated than those previously employed in recruiting experiments because the extent of the program intervention is modest. Both the Educational Benefits Test and the Enlistment Bonus Test were more widely available than the test of the 2+2+4 program.[2] Also, the 2+2+4 effects are concentrated on a group of people making a specific term-of-service choice. The two-part design was intended to provide systematic and precise estimates of how and where the program intervention affected the enlistment process. There may be only a small precounselor market expansion if contacts generally receive little information about specific Army jobs and enlistment options before Armed Services Vocational Aptitude Battery (ASVAB) testing and the job counselor meeting. The 2+2+4 test was designed to detect even modest changes in these different phases of the enlistment process.

JOB-OFFER EXPERIMENT

In the job-offer portion of the test design, individuals were randomly assigned eligibility for the 2+2+4 program through the Army's computerized job assignment system. Figure 2 illustrates the events and types of choices that recruits make during the job-offer process. Qualified Army applicants meet with job counselors and review spe-

[2]See J. M. Polich et al., 1986; and Richard L. Fernandez, 1982.

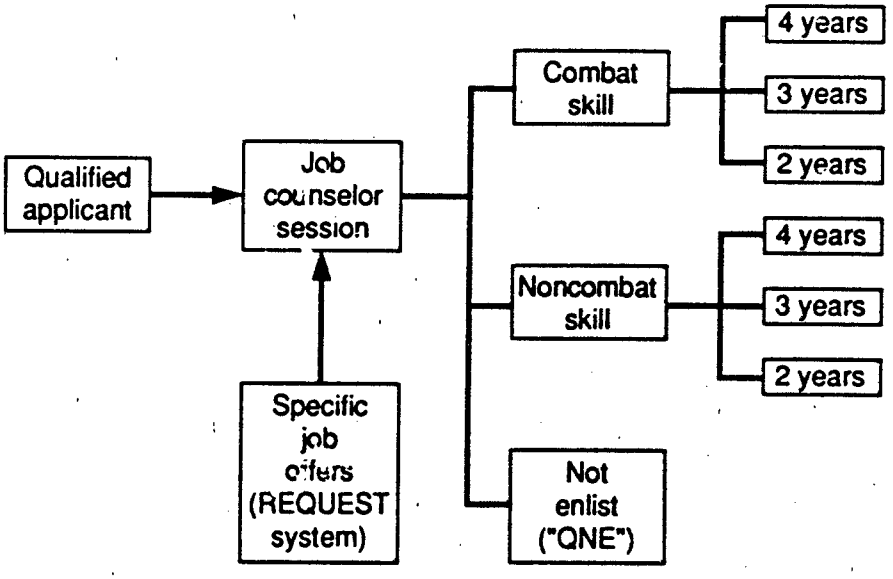

Fig. 2—Job-Offer Process

cific job offers available for their skills and desired accession date. By Army policy, recruiters are encouraged to sell prospects on "the Army," leaving discussion of specific military jobs and incentives to the job counselor. The policy is reinforced by the fact that recruiters do not always know whether a recruit is eligible for specific jobs and options. At the job counselor session, the counselor presents the applicant with specific information on his eligibility for various skills and available enlistment incentives. The specific job offers are automated into a training seat reservation program, the REQUEST system. After reviewing available job offers, the individual chooses to enlist or to not enlist. Enlistees must select a specific military job and a term of enlistment. Incentives such as ACF, bonuses, station of choice, and term length are used as inducements to encourage marginal individuals to enlist and to channel applicants into hard-to-fill specialties.

The 2+2+4 test design called for individual recruits to be randomly assigned to either the test or the control condition. The 2+2+4 program offer was available to 70 percent of the qualified recruits meeting with a job counselor; the remaining 30 percent were the control

group, for whom the 2+2+4 program option was unavailable. Individuals in the test condition were able to choose the 2+2+4 option for any available noncombat job eligible for the program. Individuals in the control condition could choose enlistment in 2+2+4 eligible occupations with standard term-of-service options or they could choose a two-year term without the ACF, but they could not choose the two-year option with ACF in exchange for the additional obligation of two years in the Selected Reserve.

The job-offer experiment had a number of methodological advantages worthy of note. It provided explicit control of the job-offer process through the computer screen displays for each applicant. The program was randomly varied across individuals, so individual characteristics were balanced across program offerings. In addition, individual variation across thousands of qualified Army applicants made it possible to obtain quick estimates of certain program effects, such as substitution effects on skill and term-of-service distributions. The randomized job-offer plan could also test other kinds of programs, and thus it might be useful in resolution of future military enlistment policy issues.

GEOGRAPHIC EXPERIMENT

Design Considerations for Estimating a Market Expansion Effect

The design called for geographic variation in program offers to explore more fully the possibility of market expansion. The nature of a possible market expansion depends on where and how the 2+2+4 program affects the enlistment decisionmaking process. Figure 3 depicts the principal factors in the early part of the process, where much of a market expansion effect might be expected to occur. A geographic-based design is the most feasible way of building systematic program variation into the early stages of the enlistment process.

The main reason for employing a geographic design in addition to the job-offer experiment was to address several hypotheses that we often heard during our discussions with people familiar with the process. Some persons voiced concern that the job-offer experiment might not capture all of the true market expansion, because recruiters might more actively "sell" a program that was consistently available to all high-quality recruits. It was also argued that a consistent implementation might increase the tendency for recruiting prospects to spread program information to others considering enlistment; this might further increase the market expansion effect.

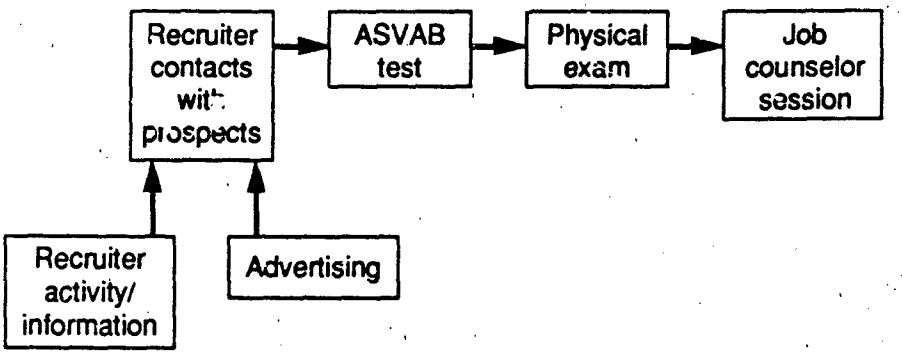

Fig. 3—Recruiting and Application Process

For that reason we decided to include one "test cell" (a set of geographic areas) in which the program was randomly offered to different individuals and another test cell in which the program was universally available to every qualified person. The intent was to facilitate comparisons between those two conditions, and to see whether a "full implementation" really produced results that appeared different from a "partial implementation." Of course, to compare either implementation with the absence of the program, we included a test cell in which the program was not offered.

Test Cells

The resulting design varied program availability across three geographically defined test cells, as shown in Table 2.

- Cell A was a control cell (the program was unavailable) and covered 20 percent of the nation's youth population.
- Cell B was a full-program implementation cell (the program was available to all qualified applicants) and also covered 20 percent of the youth population.
- Cell C was a partial-program implementation cell and covered the remaining 60 percent of the population. The job-offer experiment was in effect, with the 2+2+4 option offered to randomly selected, qualified applicants. The program was available for 70 percent of these applicants and unavailable for the remainder.

Table 2

Geographic Test Cells

Cell	Program Availability	Percent of U.S. Population
A	Not available	20
B	Available to all qualified individuals	20
C	Offered to randomly selected, qualified individuals (by job counselor)	60

Regardless of test cell, eligibility for 2+2+4 in no way affected what jobs were available to prospective recruits or their priority in the REQUEST system. Qualified applicants who were eligible for the program had the same range of choices as others, except that they had the additional option of choosing the 2+2+4 program if they entered a participating Army job.

Area Allocation and Analysis

The geographic portion of the experiment was based on a randomized assignment of dispersed sets of areas to the three test cells. The assignment algorithm resembled that employed previously in the Educational Benefits Test and the Enlistment Bonus Test. The test areas, defined by the 53 Army Recruiting Battalions in the continental United States, were balanced on a variety of factors such as (1) previous high-quality enlistment rates, (2) recruiting goals, (3) number of Army production recruiters, (4) civilian unemployment and wage rates, and (5) population demographic characteristics such as minority composition. In addition, the balancing ensured that each test cell was composed of a dispersed set of areas, including, for instance, some areas from different regions of the country. Balancing on these factors ensured that some test cells were not dominated by unusually successful or unsuccessful recruiting districts. Without balancing across battalions, a market expansion coincident with the implementation of the 2+2+4 program could be inappropriately attributed to the program when the expansion was actually due to a regional attribute such as youth employment opportunities. Figure 4 shows the allocation of Army recruiting battalions to test cells,[3] and

[3]The 2+2+4 program was unavailable in the San Juan and Honolulu battalions, but those battalions were not considered part of the test.

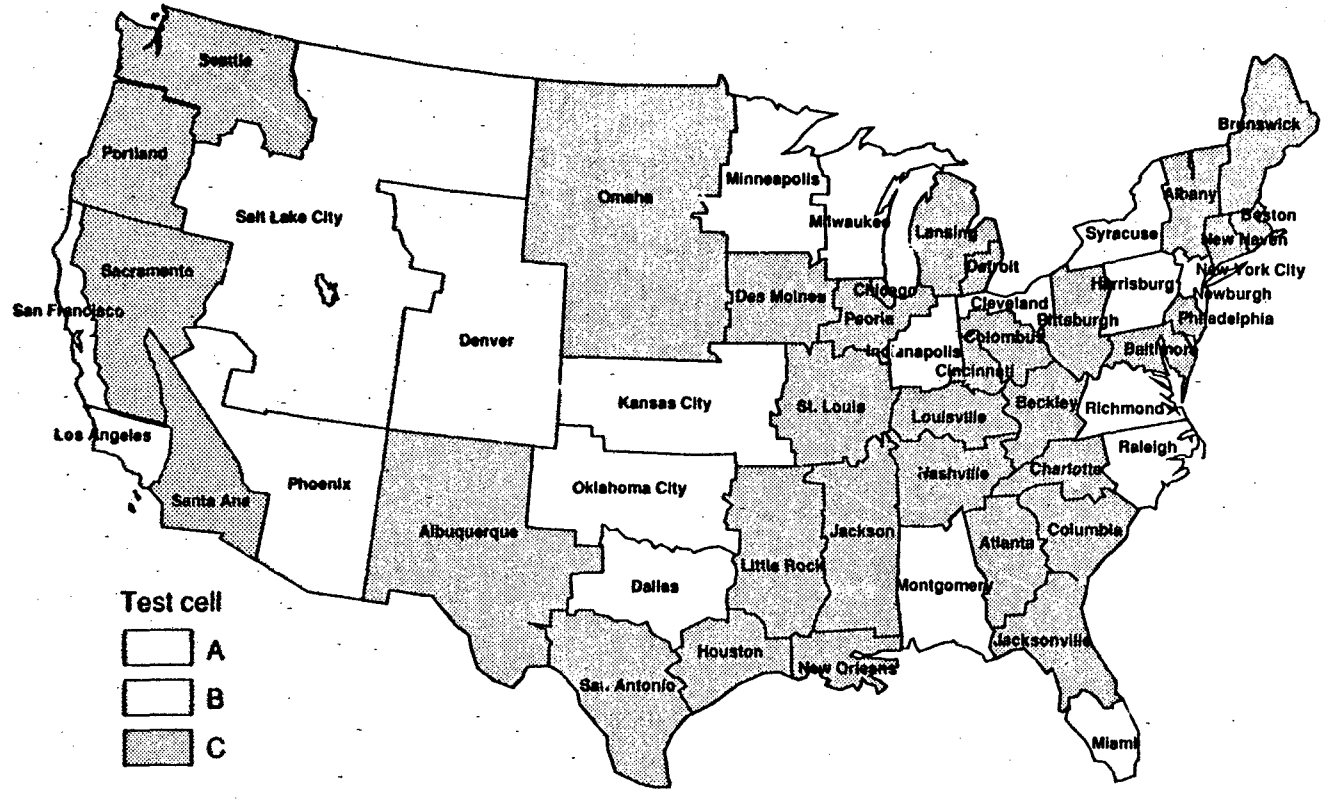

Fig. 4—Allocation of Battalions to Test Cells

Table 3 shows the values of balancing variables across test cells during the pretest base year of 1988.

The geographic experiment can be analyzed using methods similar to those applied in previous enlistment supply experiments.[4] Thus, counts of enlistment contracts were collected by month and by battalion throughout the experiment. Within each test cell and each battalion, the analysis could then compare the number of contracts during the base period before program implementation with the numbers during the test. If the program led to market expansion, then the ratio of test-period to base-period contracts would be greater in full- and partial-implementation cells (B and C) than in the control cell (A). This analysis approach adjusts for overall changes in enlistment behavior by comparing changes in contracts in the test cells with those

Table 3

Characteristics of Balanced Test Cells in 1988 Base Period

Variable	Cell A	Cell B	Cell C	Overall
Percent of nation's high-quality qualified military available (QMA) population	20.97	21.41	58.58	100.00
Unemployment percentage	5.42	5.33	5.90	5.69
Wage rate	10.23	10.26	10.42	10.38
Per capita income	10168	10739	10249	10353
Percent nonwhite	14.94	19.74	16.98	17.13
Percent high-quality QMA in northeast	24	21	24	24
Percent high-quality QMA in southeast	14	12	17	15
Percent high-quality QMA in southwest	22	18	17	18
Percent high-quality QMA in midwest	23	25	27	26
Percent high-quality QMA in west	17	24	15	17
Recruiters per high-quality QMA	.49	.48	.50	.49
High-quality female enlistment rate (%)	.95	.94	.99	.97
High-quality male enlistment rate (%)	5.06	5.03	5.25	5.17
High-quality concentration	23.90	21.39	21.74	21.88
High-quality mission per high-quality QMA	2.85	2.82	2.92	2.90
Local advertising per high-quality QMA	2.35	1.81	3.01	2.68
Percent high-quality contracts in non-combat jobs	69.03	68.51	69.09	68.99
Percent fill of Army Selected Reserve	88.97	92.15	93.16	92.51
Percent high-quality contracts in four-year contracts	72.78	71.03	73.02	72.49

[4]For a detailed discussion of the statistical model for analyzing enlistment counts and their standard errors, see Haggstrom et al., 1981.

in the control cell. In addition, the analysis used a multivariate approach, described in Sec. 4, to adjust for changed economic conditions and recruiting incentives during the test period.

3. SCOPE OF THE 2+2+4 PROGRAM

This section establishes the context of the experimental program, describing the contribution of the 2+2+4 program to the overall recruiting effort over the test period from July 1989 through September 1990. The program was available to about 62 percent of the nation's youth population: 20 percent in the full-implementation cell B and 42 percent in partial-implementation cell C (cell C covered 60 percent of the country and the program was offered to 70 percent of applicants).

The 2+2+4 program was well received and the Army wrote over 6800 enlistment contracts under the experimental offering. Table 4 shows that program "sales" (enlistment contracts written) constituted about 7 and 12 percent of high-quality contracts for men and women, respectively. Program sales were larger among women primarily because so few women are in combat specialties: 2+2+4 sales were 12 percent of noncombat sales for both men and women.[1] About 18 percent of high-quality enlistments during the experiment were women, but 28 percent of 2+2+4 participants were women. This difference also reflects the concentration of women in noncombat specialties. Program sales within the test cells are a much larger share of contracts than suggested by Table 4 because the program is unavailable to the control groups.[2]

Most new enlistees enter the delayed entry program (DEP) before accession and some separate before entering active duty. Table 4 shows that DEP attrition rates are somewhat higher for women than for men (22 percent as compared with 13 percent). Among men, combat jobs have loss rates about one or two percentage points lower than for noncombat jobs. The table shows that the DEP loss rates for 2+2+4 participants are similar to those in similar noncombat jobs and virtually the same as those for other prospective entrants in the same skill groups. During the experiment, program contracts less DEP losses were about 5700 for the 15-month test period, which was consistent with the program target of 5000 accessions per year.

[1]Women are not allowed to enlist in most Army combat specialties. The primary exceptions are skills in the air defense artillery career management field.

[2]Program sales within the test cells are discussed below and summarized in Table 7.

Table 4

Enlistment Contracts and DEP Losses During the 2+2+4 Recruiting Experiment

Group	Number of Contracts	Percent of Contracts	Number of DEP Losses	Percent DEP Loss
High-quality women	16,228	100.00	3,557	21.92
Combat	333	2.07	76	22.82
Participating noncombat	3,633	22.43	824	22.68
2+2+4 participants	1,901	11.74	436	22.94
Other noncombat	10,361	63.98	2,221	21.44
High-quality men	73,217	100.00	9,320	12.73
Combat	32,361	44.20	3,802	11.75
Participating noncombat	10,830	14.79	1,524	14.07
2+2+4 participants	4,944	6.85	700	14.16
Other noncombat	25,082	34.26	3,294	13.13
High-quality women and men	89,445	100.00	12,877	14.40
Combat	32,694	36.55	3,875	11.85
Participating noncombat	14,463	16.17	2,348	16.23
2+2+4 participants	6,845	7.65	1,136	16.60
Other noncombat	35,443	36.63	5,515	15.56

Table 5 shows the contribution of the test program to specific program eligible skills. Overall, 21 percent of the seats in the eligible skills were filled by program participants, and 32 percent of the high-quality contracts in these jobs were in the 2+2+4 program. Program participation varied somewhat across eligible skills from about 45 percent of high-quality contracts for Unit Communications Maintainer (31V), Construction Equipment Repairer (62B), and Construction Equipment Operator (62J) to less than 25 percent for Chemical Operations Specialist (54B), Chemical Equipment Repairer (63J), Heavy Wheel Vehicle Mechanic (63S), and Motor Transport Operator (88M). Program participants constituted at least 20 percent of high-quality contracts in all but one eligible skill.

Table 6 shows that program sales varied somewhat on a monthly basis, although much of this variance reflected seasonal variance in the overall level of Army enlistments. In most months, program sales ran close to the overall average of 12 percent of noncombat high-quality contracts. August 1990 was an anomaly with both the number and share of 2+2+4 contracts rising sharply, but program sales had been unusually low in May, June, and July.

Table 5

2+2+4 Contracts in Eligible Skills from July 1989 Through September 1990

MOS	Description	Number of 2+2+4 Contracts	Percent of Contracts	Percent of High-Quality Contracts
31C	Single Channel Radio Operator	341	23.1	27.1
31K	Combat Signaler	286	14.9	26.7
31L	Wire Systems Installer	142	22.1	34.2
31V	Unit Communications Maintainer	445	31.2	44.4
51B	Carpenter/Mason[a]	49	19.2	41.0
52D	Power Generator Repairer	207	17.5	25.4
54B	Chemical Operations Specialist[b]	110	14.9	20.5
55B	Ammunition Specialist	185	15.2	27.4
62B	Construction Equipment Repairer	167	24.1	46.4
62F	Crane Operator[a]	12	15.4	36.4
62J	Construction Equipment Operator[a]	100	27.5	43.3
63B	Light Wheel Vehicle Mechanic	459	12.9	26.3
63H	Track Vehicle Repairer[b]	115	15.7	33.3
63J	Chemical Equipment Repairer	3	5.3	17.6
63S	Heavy Wheel Vehicle Mechanic	210	14.5	22.5
72E	Tactical Telecommunications Operator[c]	231	28.6	41.4
74C	Telecommunications Operator[c]	86	30.7	31.7
76C	Equipment Records & Parts Spec.	374	20.9	29.3
76V	Material Storage & Handling Spec.[b]	245	25.3	39.7
76Y	Unit Supply Specialist	624	22.8	34.3
77F	Petroleum Supply Specialist	284	16.0	28.3
88M	Motor Transport Operator	383	12.1	24.1
91A	Combat Medic	1797	31.1	38.6
	Overall	6855	20.7	32.1

[a]MOS was dropped from 2+2+4 eligible group in November 1989. Enlistment counts reflect only period of 2+2+4 eligibility.

[b]MOS was added to 2+2+4 eligible group in November 1989. Enlistment counts reflect only period of 2+2+4 eligibility.

[c]In June 1990, MOS 72E (Tactical Telecommunications Operator) and MOS 72G (Automatic Data Telecommunications Operator) were combined to form a new MOS 74C (Telecommunications Operator). MOS 74C replaced MOS 72E in the group of skills eligible for 2+2+4.

Table 6

2+2+4 Program Sales by Month

Month	Number of 2+2+4 Contracts	Percent of Noncombat High-Quality Contracts
1989		
July	366	9.6
August	481	11.6
September	431	11.4
October	526	12.9
November	517	14.0
December	367	11.3
1990		
January	590	13.3
February	562	14.5
March	554	13.1
April	397	11.5
May	301	8.7
June	287	8.0
July	335	9.8
August	713	17.0
September	424	12.7

One final piece of information about the salability of the program can be gleaned from a comparison of results among persons in cell B, where the program was universally available, with results among the people in cell C, who were offered the program randomly. Table 7 shows the percentage of various groups that took the 2+2+4 experimental option in these two test cells. In fact, program shares were two or three percentage points higher in the full-implementation condition than in the condition where it was offered only at random. The next section examines the market expansion effect of full versus partial implementation.

Table 7

Shares of 2+2+4 Contracts in Test Eligible Cells (high-quality contracts)

Group	Cell B	Eligible Portion of Cell C
Men	12.1	10.1
Women	21.1	17.6
Men and Women	13.7	11.4

Program sales were a much larger share of high-quality women's contracts than of men's, but this difference largely reflects the fact that so few women entered combat specialties. As discussed above, 2+2+4 program participation among noncombat recruits was similar for men and women.

The above tabulations suggest that in broad terms, the experiment ran smoothly and appealed to many different groups. The 2+2+4 program sold well across a broad range of eligible skills, among both men and women. Program sales were consistently strong for each month of the test, but sales remained within the bounds anticipated for the experiment.

4. ENLISTMENT EFFECTS

The 2+2+4 program provided an extra incentive for potential recruits to choose a two-year enlistment in an eligible skill. The program might have three types of effects on the pattern of enlistments. First, the program might expand the market for new recruits, because the combination of a short term in a noncombat specialty and a college benefit might appeal uniquely to an untapped, college-bound subgroup in the recruiting market. Second, the program might draw recruits from skills not eligible for the program into skills offering the 2+2+4 option. Hard-to-fill noncombat skills were chosen for the 2+2+4 program. Ideally, the program would channel recruits into those skills where they are needed, and it might be easier to attract new recruits into other more attractive skills. Finally, the program might encourage migration from longer to shorter terms of service. For example, some recruits who would have enlisted for three or four years might forgo those options in favor of the 2+2+4 program. The next subsection addresses the question of market expansion, and the following subsection examines how the test altered the distribution of enlistments by skill and term of service.

The analysis is reported for male recruits only, because special problems made it impossible to assess program effects for women. Since women constitute only 18 percent of all enlistments, program effects were inherently much more difficult to measure for women than for men. A more fundamental problem, however, is that enlistment supply for women is widely perceived as demand-constrained by service policies (Daula and Smith, 1986; Polich et al., 1986; and Hosek and Peterson, 1990). Historically, the services have had little difficulty reaching their missions for women. Few low-quality women have been allowed to enlist, and low-quality missions were set at zero for nearly 90 percent of the period covered by our data. Under these circumstances, a complete supply model could not be constructed for women.

MARKET EXPANSION EFFECTS

Table 8 summarizes the changes in enlistment rates between the base and test periods, and provides an initial indication of whether the 2+2+4 program attracted new recruits to the Army. To obtain a rough picture of enlistment patterns across cells, the approach relies

Table 8

Market Expansion in High-Quality Male Market: Geographic Cell Comparisons (standard errors in parentheses)

Test Group	Number of Contracts		Percent Change, Test to Base	Percent Change, Relative to Cell A[b]
	Base Period[a]	Test Period[a]		
Control (cell A)	12,801	14,357	12.16 (1.36)	
Full (cell B)	13,239	15,228	15.00 (1.37)	2.56 (1.70)
Partial (cell C)	37,616	43,622	15.99 (0.82)	3.42 (1.40)

[a]The base period is April 1988 through June 1989, and the test period is July 1989 through September 1990.

[b]Percentage improvement in test to base period recruiting performance relative to the control cell.

on a measure of enlistment change in the test cells between a preexperimental base period and the test period, *relative* to the change in control cell enlistments between those periods. For example, suppose that base period enlistments were 15,000 in both cells A and B and that test year enlistments were 15,750 and 16,500 in cells A and B, respectively.[1] In this illustration, if all other factors were equal cell B enlistments would have grown by five percentage points as they did in cell A, whereas they actually grew by 10 percentage points. The program effect is the incremental gain in cell B enlistments relative to cell A. In the illustration this could be computed as 100[(1.10/1.05) – 1], or about 4.8 percent. Such a change analysis provides a rough indication of the market expansion effect of the 2+2+4 program.[2]

Table 8 shows that high-quality enlistments did increase substantially during the test period. Enlistments rose 12 percent in the control cell where the 2+2+4 option was unavailable. The reasons for this recruiting success cannot be assessed without a thorough analysis, but two factors may have contributed. First, reductions in the overall size of the Army recruiting mission meant that recruiters could concentrate their efforts on high-quality recruits. In the spring of 1990, recruiting missions for low-quality recruits were reduced to

[1]Cell C represents 60 percent of the country as compared with 20 percent each in cells A and B, so cell C enlistments should be about three times those of the other cells in the absence of a program effect.

[2]Later we will employ a more comprehensive multivariate approach to refine the estimates and to control for systematic changes in economic conditions and the recruiting environment. If these factors change substantially between the base and test period, then the simple change analysis may confound changes in recruiting opportunities with a test program effect.

nearly zero. Second, the recruiting market in the control cell may have been expanded by increasing the availability of two-year noncombat options that were coincident with the start of the program.

A comparison of the growth in the test cell enlistments relative to those in the control cell suggests that the 2+2+4 program expanded the market for high-quality enlistments by about 3 percent. Surprisingly, this analysis suggests that the expansion effect was slightly larger in cell C, where the program was available to 70 percent of high-quality recruits, than it was in cell B, where the program was available to all high-quality recruits. The cell B result is measured imprecisely, however, and is not significantly different from that of cell C. Nonetheless, it appears that the recruiters were vigorously promoting the test program in cell C in spite of the fact that it was not ultimately available to everybody.

Multivariate Methodology and Data

Perhaps the main factors affecting a battalion's recruiting success are local economic conditions. Previous research (e.g., Brown, 1985; Daula and Smith, 1986; and Polich et al., 1986) has shown that the civilian unemployment and wage rates have an important bearing on enlistment. The geographic test cells were balanced on these types of economic variables at the start of the test. Economic opportunities are volatile for youth populations, however, so the success of any recruiting initiative must be measured after controlling for economic conditions.

The recruiting environment also affects supply, and recruiting incentives complicate the estimation of underlying supply relationships. At any point in time, a recruiting battalion will have fixed advertising resources and recruiting staff. Dertouzos (1985, 1986) has shown that recruiting stations and recruiters use their competing resources to attract different types of recruits. They allocate their time, for example, among high school seniors and graduates and among high-quality and low-quality recruits. These time allocations reflect both the inherent difficulties of attracting different types of recruits and the Army's incentives for recruiting success. The Army's incentives are represented by recruiting missions for particular groups of recruits and award or promotions for recruiters or stations that are successful in meeting their recruiting missions.

Figure 5 presents a theoretical, illustrative view of the overall recruiting opportunities and alternatives available to a particular battalion.

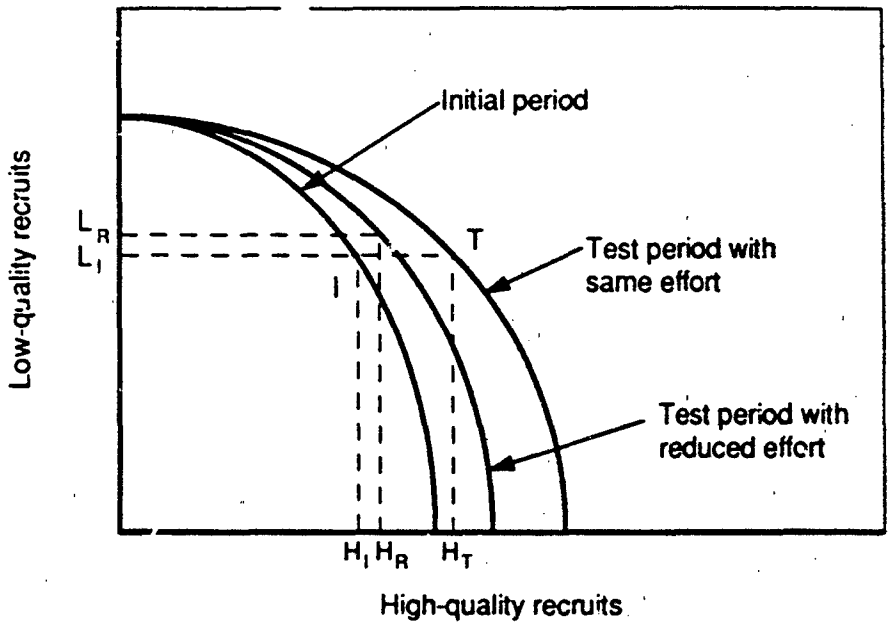

Fig. 5—Battalion Recruiting Opportunities

The diagram describes enlistment contract production possibilities for high-quality versus low-quality recruits, but the approach can be extended to other groups as well. With fixed resources, a battalion can reach the convex production transformation frontier indicated for the initial period. The battalion commander or recruiters must decide how much time to concentrate on high- and low-quality recruits. If they focus exclusively on high-quality recruits, fewer enlistment contracts will be achieved because high-quality recruits have better alternatives than low-quality recruits and require more time on average to enlist. The convexity of the curve is based on the premise that some high-quality recruits will be easy "catches," but the recruiter will require ever increasing amounts of time and low-quality recruits as the mission is dominated by high-quality recruits. In the initial period, the awards structure and quality mission are such that the battalion chooses output alternative I with H_I high-quality and L_I low-quality recruits, respectively.

This underlying tradeoff phenomenon has important implications for the evaluation of enlistment incentive experiments. Suppose that an ACF benefit or bonus test is initiated and available for high-quality

recruits only. With the same fixed resources, the test cell battalions have increased opportunities, but they may not have the appropriate incentives to take full advantage of the test program. With increased opportunities in the test period, recruiters can reduce their overall effort and still attract more high- and low-quality recruits at (L_R, H_R) than at the initial, base-period solution. Even if recruiters do not reduce effort, however, they may have incentives to proportionately increase both types of contracts and choose a tradeoff alternative between H_I and H_T. We wish to estimate the underlying market expansion (H_T less H_I), which is the effect of the test program on high-quality enlistments conditional on constant low-quality enlistments and recruiter effort.

The supply relationship is characterized in terms of a constant elasticity of transformation (CET) production frontier (Powell and Gruen, 1968; Christensen et al., 1973) of the general form depicted in Fig. 4. The basic tradeoff alternatives are given by

$$[\,\alpha\, H^{\rho} + (1-\alpha)\, L^{\rho}\,]^{(1/\rho)} = B, \qquad (1)$$

where H and L are the numbers of high- and low-quality recruits, B is a combination of economic and recruiting factors that determine the scale of battalion recruiting, α reflects the inherent difficulty in attracting H relative to L, and ρ determines the curvature (concavity/convexity) of the transformation surface. The basic structure of the model is such that increases in B (increased numbers of recruiters or local unemployment) result in output-neutral shifts in the transformation frontier. The tradeoff between H and L is

$$\partial H/\partial L = -(1-\alpha)/\alpha\, [H/L]^{1-\rho}.$$

Consider the tradeoff combinations along a ray through the origin where H = L. As α increases, more low-quality recruits must be given up to attract a single high-quality recruit. The tradeoff relationship is fixed for any given ratio of H to L.

The transformation function can be rewritten as a function of *ln* H and *ln* L.

$$(1/\rho)\, ln\, [\, \alpha \exp(\rho\, ln\, H) + (1 - \alpha) \exp(\rho\, ln\, L)\,] = ln\, B \qquad (2)$$

This expression can be simplified considerably by applying a second-order Taylor expansion around *ln* H and *ln* L and evaluating the expression for values of *ln* H and *ln* L equal to zero. The approximation is

$$\alpha\, ln\, H + (1 - \alpha)\, ln\, L + \alpha\, (1 - \alpha)\, \rho\, .5\, [\, ln\, H - ln\, L\,]^2 = ln\, B. \qquad (3)$$

The approximation is convenient, because it translates the model into a linear function of *ln* H, *ln* L, and $ln^2(H/L)$.

The CET is a more general functional form than that used in previous supply research (Dertouzos, 1985; Polich et al., 1986; and Dertouzos and Polich, 1989). These studies have defined supply as a function of *ln* H and *ln* L, neglecting the quadratic term in Eq. (3). The Cobb-Douglas style transformation frontier of the previous work is nested in the CET framework.[3]

The scale factor B is defined in terms of economic variables, recruiter resources, test cell designators, and recruiter effort. To estimate these factors, we collected monthly data on unemployment rates, wage rates, and weekly hours from *Employment and Earnings* for states and metropolitan areas. These areas were aggregated into Army recruiting battalions, and the appropriate battalion-level economic variable was constructed as a weighted average (based on population) of values within the area. The Army Recruiting Command provided battalion-level information on Army production recruiters, local advertising expenditures, and recruiting missions. The Defense Manpower Data Center provided data on the numbers of production recruiters assigned to the battalion recruiting area by other services. The supply variables are entered into Eq. (3) in log-linear form.

[3] The Cobb-Douglas style transformation frontier imposes the restriction that the tradeoff curve is convex to the origin. This restriction is not compelling, but the empirical formulation is viewed as a local first-order approximation of some arbitrary transformation function (Dertouzos, 1985). The CET approximation in Eq. (3) can be viewed as a second-order approximation to an arbitrary transformation function where the quadratic term reflects the curvature of the transformation frontier. The two specifications are discussed in greater detail in the appendix. The empirical model was estimated both ways and produced similar results.

Test cell indicators and an indicator for the test period were entered so that their coefficients represented a proportionate increase in B. Table 8 showed that high-quality enlistments were higher in the control cell during the test period than during the control period. A test period indicator was introduced to control for any national change in enlistment rates, and the test cell coefficients reflect changes in those cells relative to the national trend.

The model controls for a battalion-specific monthly effect to "net out" numerous unmeasured local factors—such as demographic characteristics, industrial structure, and attitudes toward military service. These characteristics are likely to have a persistent effect on enlistments within a battalion and during particular seasons. A fixed-effect approach (Hsiao, 1986) is used to adjust for these persistent effects by differencing all regression variables (in *ln* form) from the respective battalion and monthly means.

The final factor entering the supply relationship is recruiter effort. Effort is unobserved but the model can be solved if an underlying functional relationship is assumed between effort and observed factors. Following the earlier approach, we have adopted the assumption that recruiter effort is proportional to how well the battalions are performing relative to their high- and low-quality missions respectively, so *ln* (effort) equals

$$\gamma_1 \, ln \, (H/HM) + \gamma_2 \, ln \, (L/LM),$$

where HM and LM are high- and low-quality missions respectively. The parameters of the effort equation reflect the underlying rewards and punishments attached with performance. Both parameters are expected to be negative—an exogenous shift in high- or low-quality supply means that the recruiter will achieve the mission more easily and reduce effort. The size of γ_1 and γ_2 indicates the perceived importance of attaining each mission.

The demands for high- and low-quality recruits are centrally determined by the Army Recruiting Command. Unit vacancies, the availability of training seats, and the aptitude requirements of specific occupations shape the overall Army enlistment needs. These demands are translated into specific monthly recruiting missions for recruiting battalions. The missions are supplemented by numerous command restrictions on less desirable enlistment groups such as the number of nonhigh school graduates, the number of graduates in low AFQT

groups, and the overall number of low-quality recruits. The restrictions reflect command compromises depending on how well the Army is doing relative to its overall mission. In some months, the command will accept few if any nongraduates because recruiting has been strong and they anticipate filling available training seats with graduates. During hard recruiting times, the command may ease restrictions on some types of low-quality recruits so that available training seats are not wasted. This framework suggests that the optimal mix of high- and low-quality recruits will have the structure

$$ln\ (H/L) = \alpha_1\ ln\ HM + \alpha_2\ ln\ LM + \sum \beta_i M_i, \qquad (4)$$

where M_i are monthly dummy variables reflecting monthly command decisions on the number and composition of low-quality contracts allowed in a given month.

The market expansion effects of the 2+2+4 experiment can be sorted out by simultaneously estimating Eqs. (3) and (4), where H and L are treated as endogenous battalion-level choice variables. The system is estimated by a nonlinear three-stage least-squares methodology. The dataset consists of monthly battalion-level observations for FY87 through FY90. Table 9 shows how the variables in the model varied over the test cells during the base and test periods.

Multivariate Results

The enlistment supply results for men are reported in Table 10.[4] The market expansion effects of the 2+2+4 program are similar to those reported in Table 8. The program results in about a three percentage point increase in high-quality male enlistments in both cell B and cell C. The cell C coefficient is statistically different from zero at the .06 level.[5] The cell B coefficient is similar in size but subject to a larger standard error. In part, the imprecision of the cell B coefficient may reflect the fact that cell B is only a third the size of cell C. In

[4]The elasticity/market expansion calculations in Table 10 are based on substituting the estimated parameters into the CET function. These calculations were also performed for the Taylor series approximation of the CET and produced similar results.

[5]The .06 p-level assumes a "two-tailed" test. One could argue that a one-tailed test is more appropriate, since the 2+2+4 program only adds choices to a recruit's set of options, and hence it is hard to see how the program could depress recruiting. Using a one-tailed test, the p-level would be .03.

Table 9

Economic and Recruiting Characteristics of Test Cells During Base and Test Periods (monthly averages per battalion)

Variable	Base Period			Test Period		
	Cell A	Cell B	Cell C	Cell A	Cell B	Cell C
Hourly wage rate	10.19	10.09	10.30	10.53	10.51	10.75
Weekly hours	40.85	40.85	41.36	40.67	40.55	40.84
Percent unemployed	5.49	5.12	6.07	5.24	4.99	5.61
Army production recruiters	100.87	110.80	95.74	100.84	117.28	99.68
Other service recruiters	141.85	146.60	127.07	158.54	160.30	142.89
Local advertising expenditures (thousands of dollars)	19.32	19.52	17.42	19.55	18.68	17.95
Recruiting mission (goal):						
High-quality males	88.37	91.07	79.97	89.70	94.49	82.63
Low-quality males	55.23	59.94	57.05	38.06	45.08	40.60

Table 10

Regression Estimates of Supply Parameters for Male Recruits

Variable	Coefficient	Standard Error	t	Elasticity/Market Expansion
Cell B	.0254	.0202	1.26	.0274
Cell C	.0314	.0165	1.90	.0339
Test period	.0464	.0190	2.45	.0496
Army recruiters	.2384	.0595	4.01	.2601
Other recruiters	.1396	.0608	2.30	.1524
Local advertising	.0116	.0123	0.94	.0126
Civilian wages	−.3913	.2412	−1.62	−.4270
Civilian hours	.2858	.3390	0.84	.3118
Unemployment rate	.1264	.0385	3.28	.1379
γ_1 (HQ quota)	−.1560	.0351	−4.45	−.1702
γ_2 (LQ quota)	−.0020	.0116	−0.17	−.0022
α (bias)	.9195	.0194	47.43	
ρ (curvature)	.8768	.5445	1.61	

auxiliary regression runs, cells B and C were pooled, and the combined market expansion effect was estimated as 3.2 percent, which was also statistically different from zero at the .06 level.

The remaining model factors reported in Table 10 have the anticipated effects on supply. The coefficient on the test period indicator shows that the test period was an above average recruiting period

with overall high-quality enlistments running about five percentage points higher than in the base period. Army recruiter strength had a positive effect on enlistments with an elasticity of about .24. Surprisingly, other service recruiter strength had a complementary but smaller effect on Army recruiting—we had expected that other recruiters would draw or compete away recruits from the Army. The effects of local advertising expenditures on enlistments are difficult to parcel out from this type of data. The advertising coefficient has the right sign but is insignificantly different from zero.

Wages, hours, and unemployment were included in the model to adjust for changes in local economic conditions. The wage effect implies an elasticity of about –.43, although the effect is measured imprecisely. Civilian hours was expected to have a negative coefficient, but the positive coefficient is smaller than its standard error. Finally, the unemployment coefficient implies an elasticity of high-quality enlistments with respect to the unemployment rate of about .14.

The recruiter effort parameters are similar to those reported in earlier studies (Polich et al., 1986; and Dertouzos and Polich, 1989). A 10 percent exogenous increase in high-quality enlistment supply is associated with a 1.7 percent decline in battalion recruiting effort. Other things equal, supply increases are partially offset by changes in local recruiter effort. The coefficient on low-quality mission is insignificant. The results highlight the fact that recruiters attach primary importance to meeting their high-quality mission.

Changes in Conversion Rate of Applicants into Contracts

The 2+2+4 program could increase the number of individuals joining the Army through a combination of methods:

> *Expanded applicant pool.* The program might make it easier for recruiters to convince individuals that they should apply for the Army. If the applicant pool grows, then the number of Army enlistments is likely to increase.
>
> *Increased conversion rate.* Even if the program did not increase the applicant flow, the program might attract applicants who would otherwise not have joined the Army. Under this scenario, the conversion rate of applicants into contracts would increase in the experimental cell, and enlistments would increase.

The two types of effects may work in complementary or conflicting directions. If the program attracts a pool of new applicants previously not interested in the Army, then the conversion rate of these

marginal applicants may be lower than that of the existing, preexperimental group, and the overall conversion rate could fall.

Enlistment patterns in cell C provide evidence on whether the 2+2+4 program increased the conversion rate of Army applicants into enlistments. Within cell C, program eligibility is randomized across applicants so that 30 percent of the applicants are ineligible for the 2+2+4 program and 70 percent are eligible. If the program had no effect on the conversion rate, then 70 percent of the enlistment contracts in cell C would be in the program-eligible portion of the cell. Alternatively, suppose that 100 individuals signed enlistment contracts in the program-ineligible portion of cell C; then we would expect 233 contracts in the program-eligible portion of cell C.[6] If the conversion rate is increased by the program, then we would expect more than 233 contracts in the eligible cell.

The results show 12,951 high-quality male enlistments in the ineligible portion of cell C, so we would anticipate 30,219 enlistments in the eligible cell. Actual enlistments in the eligible cell were 30,681, so the evidence suggests a program effect of about 1.53 percent with a standard error of 1.06. This result is measured somewhat imprecisely, but it suggests enlistment contracts from a constant pool of applicants would increase by 1.5 percent under program eligibility. The market expansion effect is about 3 percent, so half the increase in enlistments may be due to an increase in the conversion rate and about half due to an increase in the pool of Army applicants under the program.

Comparison with Previous Experiments

The results suggest that the 2+2+4 program expanded the high-quality male market by about 3 percent. This expansion is smaller than the 9 and 5 percent expansions reported in the educational benefits and bonus experiments (Fernandez, 1982; Polich et al., 1986). The smaller expansion was anticipated, however, because the 2+2+4 program is a marginal expansion of the existing ACF framework and not a fundamental new enlistment program. Table 11 shows that the market expansion effect associated with the 2+2+4 program is markedly similar to that for the previous, larger-scale experiments, after adjusting for program size.[7] The 2+2+4 results imply that

[6]The expected number of contracts in the eligible portion of cell C is 7/3 times the number of contracts in the ineligible portion of cell C.

[7]The comparisons in Table 11 should not be exaggerated. The experiments were tested in different time periods and applied to different ranges of skills. Also, educa-

Table 11

Market Expansion in Army Enlistment Experiments

Test Program	Percent of High-Quality Training Seats Available[a]	Market Expansion
Educational benefits	57	8.9
Enlistment bonus	30	4.9
2+2+4	20	3.2

[a]Training seats available reflect the total number of pretest-year individuals trained in the occupations that were eligible for the experimental program.

about 25 to 30 percent of the men taking the program are new recruits.

SKILL AND TERM-OF-SERVICE EFFECTS

The experiment provides two sources of evidence for assessing the skill and term-of-service effects of the experiment. Traditionally, these effects have been deduced from the types of aggregate data used in the market expansion assessment. In this test, the job-offer portion of the test allows us an alternative method to assess the distribution effects. In the job-offer experiment, skill and term-of-service choices can be compared for the 2+2+4 eligible and ineligible populations. Individual randomization allows us to implicitly control for a variety of unmeasured and unknown factors that are not controlled for in the aggregate approach.

Aggregate Data Approach

The previous model can be extended to examine the skill-channelling and term-of-service effects of the 2+2+4 program. The number of high-quality enlistments in 2+2+4 eligible skills are assumed to be proportional to the number of high-quality recruits, the availability of the test program, and a set of demand or policy variables that are characterized by indicators for the months of the base and test periods. Coefficients on indicator variables for the corresponding test cells show how program availability affects job choice.

Table 12 shows that the 2+2+4 program drew recruits into hard-to-fill noncombat specialities. The skill-channelling effect was a 19 and 16

tional benefits and bonus programs may have very different costs (Schmitz et al., 1989; Hogan et al., 1990).

Table 12

Regression Estimates of Skill-Channelling and Term-of-Service Effects for Male Recruits

Test Cell	Coefficient	Standard Error	t
Skill-channelling			
Full (cell B)	.1897	.0763	2.48
Partial (cell C)	.1581	.0617	2.56
Three-year term			
Full (cell B)	–.2293	.0386	–5.94
Partial (cell C)	–.1572	.0313	–5.02
Four-year term			
Full (cell B)	–.0528	.0351	–1.51
Partial (cell C)	–.0262	.0284	–0.92

percentage increase in high-quality male enlistments in cell B and cell C, respectively. Full implementation is associated with a slightly higher level of skill-channelling than partial program implementation in cell B, but the point estimates are not significantly different from one another. The results suggest that the program is having the desired effect of increasing the share of enlistments in 2+2+4 eligible skills.

A similar approach can be used to model changes in the term-of-service distribution. High-quality enlistments for three- and four-year terms in eligible specialities are assumed to be proportional to the number of high-quality enlistments in those skills, indicators for test availability, and monthly dummies for command policies and decisions. Two-year enlistments are the residual group and need not be estimated separately.

Table 12 shows that, holding constant the number of high-quality enlistments in eligible skills, most 2+2+4 enlistments are drawn from the group of three-year enlistees. The share of four-year enlistments in eligible specialties is not signifificantly altered by the 2+2+4 program.

Job-Offer Approach

The job-offer portion of the experiment provides direct evidence of how test eligibility affects term of service and skill. Individual differences were randomized by the experimental design, so that the behavior of 70 percent of recruits eligible for the option can be compared

with the behavior of a 30 percent control population within test cell C. During the 15-month test period, about 53,000 high-quality recruits signed Army enlistment contracts in cell C. Because the sample is large and because each individual is randomly assigned to one of the two test groups, the comparisons between groups are quite precise.[8]

Table 13 describes the 2+2+4 program's "buy-down" effect on term of service. Program eligibility was associated with a 3.3 percentage point increase in the share of two-year enlistments, with three- and four-year enlistment shares each falling by 1.7 and 1.6 percentage points, respectively. The buy-down effects of the program are partially offset by the program requirement that participants must serve a two-year enlistment *plus training time*, so that 2+2+4 participants will actually spend about two years and five months on active duty.

To assess the importance of these changes in enlistments for various terms of service, we compared the expected number of enlistments in the eligible portion of cell C with the actual number.[9] Table 14 shows the results of that calculation, which also permits us to derive a standard error for the relative percentage change in enlistment contracts. The results show that male two-year enlistments rose by 17 percent in the 2+2+4 eligible cell, three-year enlistments fell by 8 percent, and four-year enlistments were not significantly altered. These results are quite similar to those from the aggregate data analysis described in Table 12.

Table 15 shows the effectiveness of the 2+2+4 program in channelling recruits into participating noncombat skills. In the 2+2+4 eligible cell, 23 percent entered participating skills as compared with 20 percent for those who were ineligible for the test. The buy-over was a 2.3 percentage point decline in combat skills and a .6 percentage point decline in other noncombat skills.

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[8]The aggregate data analysis suggests that the skill channelling and term-of-service effects are similar in the full- and partial-implementation modes.

[9]Table 14 reflects the same enlistment counts as reported in Table 13. For example, the proportionate increase in two-year enlistments is .171 (7517 divided by 7/3 times 2750 minus unity). The numbers in Table 14 reflect the increase in applicant conversion rate associated with the program. An alternative approach would hold constant the conversion rate and examine the proportionate increase in the percentage of two-year enlistments. In this case, the proportionate increase in two-year enlistments is .156 (24.5/21.2 minus unity). Both methods produce similar results for term-of-service and skill-channelling effects because the change in the conversion rate is small.

Table 13

Distribution by Term of Service: Evidence from the Job-Offer Experiment (high-quality male recruits in Cell C)

Test Group	Term of Service			Total
	2 years	3 years	> 3 years	
2+2+4 ineligible	2,750	2,354	7,847	12,951
	(21.2)	(18.2)	(60.6)	(100.0)
2+2+4 eligible	7,517	5,070	18,094	30,681
	(24.5)	(16.5)	(59.0)	(100.0)

NOTE: Percentages are shown in parentheses. Percentages may not sum to 100 because of rounding.

Table 14

Changes in Term-of-Service Choices from the Job-Offer Experiment (high-quality male recruits in Cell C)

Group	Relative Percent Gain in Actual to Expected Contracts	Standard Error
Two years	17.15	2.61
Three years	−7.70	2.30
Four years	−1.18	1.34

Table 15

Distribution by Skill: Evidence from the Job-Offer Experiment (high-quality male recruits in Cell C)

Test Group	Skill Group			Total
	Combat	Participating Noncombat	Other Noncombat	
2+2+4 ineligible	5,822	2,561	4,568	12,951
	(45.0)	(19.8)	(35.2)	(100.0)
2+2+4 eligible	13,115	6,934	10,632	30,681
	(42.7)	(22.6)	(34.6)	(100.0)

NOTE: Percentages are shown in parentheses. Percentages may not sum to 100 because of rounding.

Table 16 shows how program eligibility affected individual occupational choices. High-quality male enlistments rose 16 percent in participating noncombat skills and fell by 4 percent in combat skills with no significant change in other noncombat enlistments. The program is drawing recruits away from combat skills, but the buy-over is small relative to the overall size of the combat enlistment program.

Reserve Obligations and Two-Year Programs

The test results indicate that many people are willing to accept a reserve commitment in exchange for the ACF benefits. Not only did the program sell well, but the test results show that few recruits will choose a two-year noncombat GI Bill enlistment if the 2+2+4 option is available. In the absence of the test, about 7 percent of high-quality recruits chose the two-year noncombat GI Bill offered in skills participating in 2+2+4. In the 2+2+4 eligible portion of cell C, less than 1 percent of recruits chose the two-year GI Bill offered in those skills. Apparently, recruits are quite willing to accept the additional reserve obligation associated with the 2+2+4 program in exchange for the extra ACF benefits. The test results suggest that the Army might consider broader linkage of active and reserve service along the lines of the 2+2+4 program, provided the 2+2+4 participants follow through with their reserve service obligation.[10]

An interesting unanticipated aspect of the test has been the popularity of two-year noncombat seats without the ACF. Before the test, the two-year option was seldom available, although the Army had the legal authority to use a two-year enlistment option without the ACF in

Table 16

Changes in Skill Choices: Evidence from the Job-Offer Experiment (high-quality male recruits in Cell C)

Group	Relative Percent Gain in Actual to Expected Contracts	Standard Error
Combat	–3.46	1.52
Participating noncombat	16.04	2.68
Other noncombat	–0.25	1.76

[10]The ACF entitlement associated with the 2+2+4 program requires Selected Reserve affiliation and satisfactory performance. It is hoped that program participants will provide experienced, trained manpower to the Selected Reserve. The extra ACF cost is not incurred unless the program participant provides Selected Reserve service.

noncombat jobs. With the advent of the test, more two-year seats were opened in skills participating in the experiment. In the control cells, individuals were able to choose the two-year option without the ACF. In the experimental cells, individuals could choose between 2+2+4 or a two-year option without the ACF in the participating skills. In the control group (cell A), two-year GI Bill enlistments in participating noncombat skills rose by a factor of three between the base and test periods. The availability of two-year enlistments in other noncombat skills did not change so much, and two-year enlistments in those skills rose by about 42 percent. Even without ACF benefits, the two-year option is a popular program for drawing recruits into hard-to-fill specialties. The term-of-service buy-down is mitigated by the fact that the actual active-duty obligation is two-years plus training time.

EFFECTS ON OBLIGATED MAN-YEARS

The net effect of the program can be assessed by comparing the total obligated active-duty man-years under the test and control conditions.[11] The market expansion effect of the program is partially offset by the reduction in average man-years as more recruits enter two-year programs (two-years and about five months). The 3 percent increase in high-quality enlistment is associated with a 2 percent increase in overall obligated man-years. The difference is concentrated in those skills participating in the 2+2+4 program in which obligated man-years increased by 11 percent despite a reduction in average term length from 3.3 years to 3.1 years. Obligated man-years changed little for other noncombat and combat skills—man-years rose 1 percent in other noncombat skills and fell by 1 percent in combat skills. The smaller changes in obligated man-years in the nonparticipating skills reflect the fact that a large percentage gain for a small base group (participating skills) can be offset by a small percentage gain in a large base group (nonparticipating skills).

[11]This analysis is based on the term-of-service and skill-channelling effects measured in the job-offer portion of the experiment. The aggregate data analysis suggests that these effects did not differ much between the full- and partial-implementation modes.

5. CONCLUSIONS

The 2+2+4 experiment has demonstrated that substantial numbers of recruits are willing to commit for two years in the Selected Reserve in order to obtain ACF benefits. During the 15-month experiment, the Army wrote over 6800 2+2+4 enlistment contracts. These sales constituted about 7 and 12 percent of high-quality sales for men and women, respectively. The higher program participation rate for women reflected the fact that women are ineligible for most combat skills: 2+2+4 sales were 12 percent of noncombat contracts for both men and women.

Program sales were strong throughout the test period and across a broad range of eligible skills. Virtually every eligible skill benefited from the 2+2+4 program. There were some gender-specific sales patterns—for example, women accounted for a disproportionately small share of maintenance and construction job sales, but this reflected a pattern that also prevailed in the absence of the program.

The 2+2+4 program expanded the market for high-quality male recruits by about 3 percent. This expansion is smaller than the 9 and 5 percent expansions reported in the educational benefits and bonus experiments (Fernandez, 1982; Polich et al., 1986). The smaller expansion was anticipated, however, because the 2+2+4 program is a marginal expansion of the existing ACF framework and not a fundamentally new enlistment incentive.[1] A 3 percent expansion is comparable with that of the previous programs after controlling for the scale of the programs. The results imply that about 25 to 30 percent of the men taking the program are new recruits.

The analysis also assessed the extent to which the 2+2+4 program may have encouraged recruits to "buy-down" enlistments from longer terms of service or to "buy-over" enlistments from hard-to-fill combat skills. The test results indicate that the buy-down phenomenon was minimal. The share of male recruits choosing two-year enlistments rose from about 20 percent in the ineligible test cell to 24 percent in the eligible cell. The increase in two-year enlistments was driven primarily by a decline in three-year enlistments. Male four-year en-

[1]Separate supply estimates could not be obtained for women because women constitute a small share of overall enlistments and because women are demand constrained in the current recruiting environment. Combined male and female estimates produced expansion effects that were comparable to those reported for males separately.

listments did not decline significantly. Moreover, the buy-down effect from the three-year term will be partially offset by the program requirement that participants serve a two-year enlistment *plus training time*, or about two-and-a-half years on active duty.

The program did channel recruits into those hard-to-fill noncombat skills that participated in the 2+2+4 program. The share of recruits in participating skills rose three percentage points in the test eligible cell as compared with the ineligible cell, representing a 16 percent increase in enlistments in the participating noncombat skills. The buy-over came entirely from combat skills, where the number of enlistment contracts declined by about 3.5 percent.

Overall, the program seems to have accomplished its objectives for active-duty recruiting. The 2+2+4 option sold readily and benefited virtually all of the occupational specialties for which it was tested. About 7 percent of all high-quality male enlistment contracts were written under the 2+2+4 program. Moreover, the analysis indicates that the program attracted additional high-quality recruits into the Army and caused only a small number to change from a longer term of service to a shorter term. These results suggest that many people were willing to make the commitment to reserve service, in the process providing an additional supply of manpower to both the active and reserve components.

The reserve implications of the 2+2+4 program will not be known until 1992 or 1993 when program participants complete their active-duty obligation and begin transitioning into the Selected Reserve. Several factors suggest, however, that the 2+2+4 program is likely to provide substantial reserve benefits. Historically, two-year recruits have been much more likely to provide trained man-years to the Selected Reserve than have four-year enlistees. About 45 percent of two-year enlistees join the reserves—a rate 10 to 15 percentage points higher than for other high-quality enlistees.[2] Among reserve entrants, 50 percent of two-year personnel enter a matching MOS (about four percentage points lower than for others). On net, the higher transition rate more than offsets the slightly lower MOS match rates. The 2+2+4 participants should have both higher transition rates and higher match rates, because the ACF payment provides additional incentive to join a unit and accept a matching MOS. This

[2]Transition rates are computed for the group of enlistees who complete their initial enlistment term and do not reenlist. Recruits who leave before the end of their term are frequently either ineligible to join the Selected Reserve or require a waiver for reserve eligibility.

historical evidence suggests that the 2+2+4 program will funnel experienced, trained personnel into the reserve force and provide a substantial payoff in meeting future reserve manning requirements.

Appendix

COMPARISON OF CONSTANT ELASTICITY OF TRANSFORMATION (CET) AND TRADITIONAL REGRESSION SPECIFICATIONS

The CET transformation frontier is more general than the traditional frontier (Dertouzos, 1985; Polich et al., 1986; and Dertouzos and Polich, 1989). The traditional model implicitly implies increasing returns to specialization whereas the CET parameterization allows for decreasing, constant, or increasing returns to specialization. Differences between the two specifications will depend on whether the restriction in the traditional formulation is binding. Recall that the Taylor series approximation to the CET function is

$$\alpha\, ln\, H + (1-\alpha)\, ln\, L + \alpha\,(1-\alpha)\,\rho\, .5\,[\, ln\, H - ln\, L\,]^2 = ln\, B.$$

The approximation can be interpreted as a second-order Taylor's approximation to an arbitrary frontier, and the CET derivation provides a more specific interpretation of the coefficient on the quadratic term. The traditional model is interpreted as either a Cobb-Douglas style frontier or a first-order Taylor's approximation of an arbitrary frontier and is written as

$$\alpha\, ln\, H + (1-\alpha)\, ln\, L = ln\, B.$$

The CET specification nests the traditional model—the traditional model is a special case in which the coefficient on the quadratic term equals zero in the general case or ρ equals zero in the CET derivation.

Table A.1 shows that the multivariate regression results presented in Sec. 4 are quite similar to those that would have been obtained from the more traditional regression specification (Dertouzos, 1985; Polich et al., 1986; and Dertouzos and Polich, 1989). This similarity reflects the fact that the estimated transformation frontier is virtually linear

Table A.1

Comparison of CET and Traditional Regression Specifications

	CET Model		Traditional Model	
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Cell B (full)	.0276	.0220	.0252	.0201
Cell C (partial)	.0339	.0179	.0321	.0164
Test period	.0496	.0202	.0453	.0188
Army recruiters	.2601	.0648	.2345	.0592
Other recruiters	.1523	.0663	.1405	.0606
Local advertising	.0126	.0134	.0113	.0122
Civilian wages	−.4269	.2632	−.4449	.2392
Civilian hours	.3117	.3699	.2710	.3380
Unemployment rate	.1378	.0420	.1230	.0383
γ_1 (HQ quota)	−.1701	.0382	−.1486	.0345
γ_2 (LQ quota)	−.0021	.0126	−.0074	.0090
α (bias)	.9195	.0194	.9212	.0157
ρ (curvature)	.8768	.5445	—	—

NOTES: The CET estimates have been converted to elasticities for comparison with the coefficient estimates of the traditional model, which are inherently in elasticity form. The coefficients on test cells show proportionate change in high-quality enlistments in the corresponding cell relative to the control cell. Similarly, the coefficient on the test period coefficient indicates the proportionate change in high-quality enlistments between the test period of July 1989 through September 1990 relative to the pretest period of October 1987 through June 1989.

over the range of high- and low-quality enlistments observed in the data. The curvature of the transformation frontier in the traditional case is

$$\partial^2 H/\partial L^2 = (1-\alpha)/\alpha \ [H/L^2].$$

This curvature is always negative but the second derivative evaluated at the sample means is only .0009, so the function is nearly linear. The curvature of the CET transformation frontier depends on the value of ρ where

$$\partial^2 H/\partial L^2 = (1-\alpha)/\alpha \ (1-\rho) \ (H/L)^{-\rho} \ [H/L^2].$$

Increasing/decreasing returns to scale are implied by values of ρ less/greater than one. In this empirical instance, the freeing up of ρ is not of much importance because the estimated ρ does not differ significantly from zero. The second derivative of the CET function evaluated at the sample means is .0001, so the underlying function is even more linear than implied by the traditional specification. Although ρ is measured imprecisely, ρ is much closer to one (constant) returns than to zero. The transformation frontier is virtually linear over the ranges of H and L observed in the data, so the underlying tradeoff between H and L ($\partial H/\partial L$) is constant for observed combinations of H and L.

BIBLIOGRAPHY

Brown, Charles, "Military Enlistments: What Can We Learn from Geographic Variation?" *American Economic Review*, Vol. 75, March 1985.

Buddin, Richard, and J. Michael Polich, *The 2+2+4 Recruiting Experiment: Design and Initial Results*, RAND, N-3187-A, October 1990.

Christensen, Laurits R., Dale W. Jorgenson, and Lawrence J. Lau, "Transcendental Logarithmic Production Frontiers," *Review of Economics and Statistics*, February 1973.

Daula, Thomas V., and D. Alton Smith, "Recruiting Goals, Enlistment Supply, and Enlistments in the U.S. Army," in Curtis L. Gilroy (ed.), *Army Manpower Economics*, Westview Press, Boulder, Cclorado, 1986.

Dertouzos, James N., *Recruiter Incentives and Enlistment Supply*, RAND, R-3577-FMP, May 1985.

Dertouzos, James N., "Microeconomic Foundations of Recruiter Behavior: Implications for Aggregate Enlistment Models," in Curtis L. Gilroy (ed.), *Army Manpower Economics*, Westview Press, Boulder, Colorado, 1986.

Dertouzos, James N., and J. Michael Polich, *Recruiting Effects of Army Advertising*, RAND, R-3577-FMP, January 1989.

Fernandez, Richard L., *Enlistment Effects and Policy Implications of the Educational Assistance Test Program*, RAND, R-2935-MRAL, September 1982.

Haggstrom, Gus W., Thomas J. Blaschke, Winston K. Chow, and William Lisowski, *The Multiple Option Recruiting Experiment*, RAND, R-2671-MRAL, November 1981.

Hogan, Paul F., "The Army College Fund: Effects on Attrition, Reenlistment, and Cost," in David K. Horne, Curtis L. Gilroy and D. Alton Smith (eds.), *Military Compensation and Personnel Retention: Models and Evidence*, Army Research Institute for the Behavioral and Social Sciences, Alexandria, Virginia, 1990.

Hosek, James R., and Christine E. Peterson, *Serving Her Country: An Analysis of Women's Enlistment,* RAND, R-3853-FMP, January 1990.

Hsiao, Cheng, *Analysis of Panel Data,* Cambridge, University Press, Cambridge, England, 1986.

National Defense Authorization Act for Fiscal Year 1991, U.S. Senate Report 101-384, July 1990.

Polich, Michael J., James N. Dertouzos, and S. James Press, *The Enlistment Bonus Experiment,* RAND, R-3353-FMP, April 1986.

Powell, Alan A., and F.H.G. Gruen, "The Constant Elasticity of Transformation Production Frontier and Linear Supply System," *International Economic Review,* October 1968.

Schmitz, Edward J., Charles Dale, and Alan F. Drisko, "The Use of the Army College Fund: Implications for Program Cost Effectiveness," in T.R. Gulledge, Jr., and L.A. Litteral (eds.), *Cost Analysis Applications of Economics and Operations Research,* Springer-Verlag, New York, 1989.

United States Senate, *National Defense Authorization Act for Fiscal Year 1991,* Report Number 101-384, Washington, D.C., July 1990.